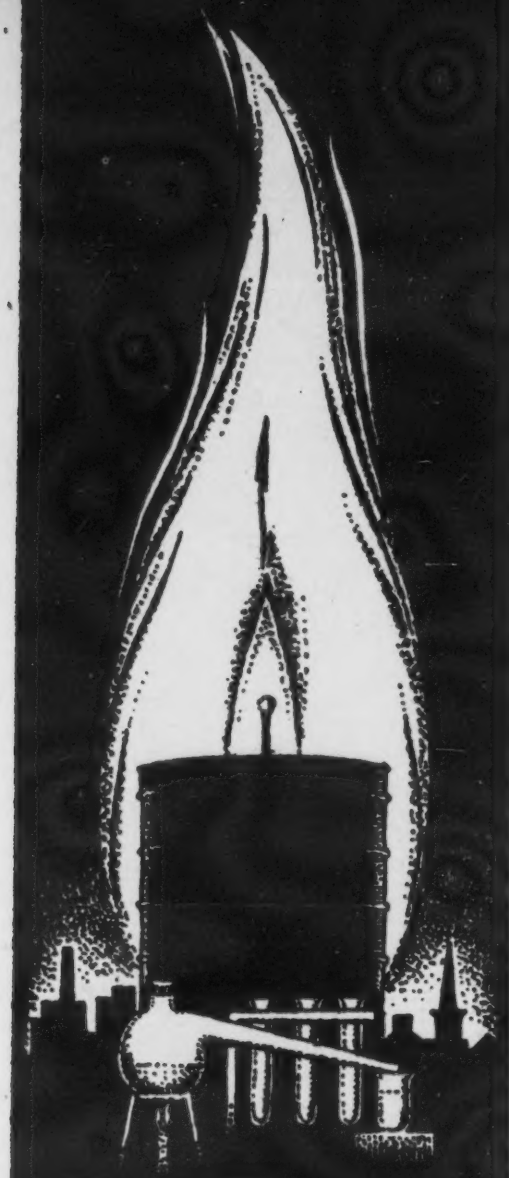

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GAS ABSTRACTS

GAS ABSTRACTS was started in 1945 by the Institute of Gas Technology to survey current technical journals, to select articles pertaining to the Gas industry, and to prepare abstracts of these articles, stressing their significance to the Gas Industry.

Selection of Articles: Each month the periodicals listed on the last page are examined and articles pertaining to the production or manufacture, distribution, transmission or storage, and utilization of natural and manufactured gas and related subjects are selected for abstracting by individual staff members of the Institute of Gas Technology. When possible the significance of the article to the Gas Industry is stressed.

Classification of Abstracts: The abstracts are grouped under twelve headings for presentation and are arranged alphabetically by subject in each group. The headings and subject matter included in each are presented below:

1. The Gas Industry will include general information and news items, statistics, business regulations and other articles of general interest.

2. Appliances - Domestic and Commercial will include burners, ranges, cooking equipment, air conditioning equipment, water heaters and other gas appliances for domestic and commercial use.

3. Combustion and Industrial Furnaces will include combustion of gaseous, liquid and solid fuels; design of industrial furnaces; control of furnace atmospheres.

4. Carbonization and Gasification will include manufacture and purification of producer gas, blue gas, carburetted water gas, synthesis gas; carbonization and gasification of coal; and gasification of oil.

5. Natural Gas and Natural Gas Condensates will include production, transmission, distribution and storage of natural gas and natural gas condensates; distribution of LP-gas mixtures; carbon black and chemicals from natural gas and natural gas condensates.

6. Petroleum and Synthetic Liquid Fuels will include production, refining-cracking, alkylation, isomerization, and utilization of petroleum and production of synthetic liquid fuels by the Fischer-Tropsch reaction and hydrogenation.

7. Analytical Methods and Tests will include new and improved methods pertaining to gas making materials, processes, products, and by-products.

8. General and Physical Chemistry will include data on chemical and physical properties of elements and inorganic compounds; new reactions; and methods for carrying out established reactions.

9. Organic Chemistry will include data on organic compounds closely related to the Gas Industry; new reactions; new methods for carrying out established reactions.

10. Chemical Engineering will include data and methods for fluid flow, heat transfer, and unit operations of distillation, evaporation, extractive drying, and filtration.

11. Process Equipment and Instrumentation will include information on new equipment for process operations and process control.

12. Materials of Construction will include new developments in refractories, heat and corrosion resistant materials, new alloys applicable to the Gas Industry, and other materials of construction.

13. New Books will include recent books pertaining to the field of gas technology.

Annual Index: Author and subject indexes will be issued at the end of the year.

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I. THE GAS INDUSTRY

MANUFACTURED GAS INDUSTRY

Steinwedell, W.E. MANUFACTURED GAS FOR THE FUTURE. *Amer. Gas J.* 165, 25-50 *(1946) August.*

Manufactured gas for the future must successfully compete with other sources of heat and, therefore, must be produced at a minimum of manufacture and production costs. Since the cost of oil has been reduced, an oil gas or an enriched reformed oil gas, which has a heating value of about twice the heating value of manufactured gas, is the proper gas to manufacture and distribute since all expensive fuel and ash handling, equipment, labor, etc. in connection with the handling of coal and coke are entirely eliminated. In many cases LP gases can be used advantageously for emergency and peak loads. Reforming of butane and propane gases in carburetted water gas sets makes a gas of about 1000 Btu for peak load use. Reformed oil refinery gas can also be used advantageously. Improvements in equipment and operations will also increase the supply and reduce the cost.

—R.S. Goodrick

NATURAL GAS TRANSMISSION COSTS

Flanders, J.E. COST BEHAVIOR IN NATURAL GAS TRANSPORTATION. *Gas Age* 98, 22-25 *(1946) August 8.*

An analysis of costs of natural gas transmission is shown. The construction and operating costs are reasonable. Present day average values do not represent those of any one actual company. Costs are presented for 16 inch and 24 inch lines of various lengths and for varying load factors. It is shown that the cost of transporting a unit amount of gas increases as the load factor decreases and as the distance increases. Costs are lower for the 24 inch line than for the 16 inch line per Mcf; thus for a length of 1500 miles the delivery cost per Mcf is $21.24 for the former and $32.69 for the latter. Data are based on an annual delivery of 87,600,000 Mcf for the 24 inch line and 29,200,000 Mcf for the 16 inch line. Compressor stations are designed on the basis of a 1.6 compression ratio and consist of one field station and additional booster stations spaced at 100 mile intervals.

—J.D. Parent

TEXAS GAS PRODUCTION

Weber, G. 170,000 GALLONS OF LIQUID PRODUCTS PER DAY. *Oil & Gas J.* 45, 86-89 *(1946) July 20.*

The United Gas Pipe Line Company plans to process 150,000,000 cu.ft. of gas per day from the Carthage, Texas, gas field. About 170,000 gallons of liquid products including motor fuel, kerosene, naphthas, butanes, natural gasoline and liquefied petroleum gases will be produced daily.

—C.H. Riesz

2. APPLIANCES - DOMESTIC AND COMMERCIAL

AERATED BURNERS

Minchin, L.T. AERATED BURNERS OF HIGH STABILITY. *Gas J.* 248, *188-189 (1946) July 31; 231-232 August 7; 277-281 August 14.*

The fundamental causes of and remedies for lighting back in domestic gas burners are discussed. Means for preventing burning at the jet or within the injection tube are also outlined.

—M.F. Knoy

4. CARBONIZATION AND GASIFICATION

CARBONIZATION

Illingworth, S.R. REACTIONS IN THE RETORT AND THEIR INFLUENCE ON THE NATURE AND YIELD OF THE PRODUCTS OF CARBONIZATION. *Gas J.* 247, *848, 853 (1946) May 22.*

Carbonization of coal is a time-temperature change. The amount of volatiles at any one temperature varies with the type of coal. By extraction of coal with solvents three types of components are identified; (1) the alpha component which is the insoluble residue, (2) the Beta component which is the portion soluble in phenol but insoluble in benzene and (3) the Gamma components which melt and soften at low temperatures. The initial stages of carbonization release the less stable beta and gamma components. The plastic layer begins to form when the wall portion of the charge reaches a temperature high enough (approximately 300°C) to cause liquation of the gamma components and their absorption into the adjacent layer of the charge. The layer on further rise in temperature undergoes carbonization and is converted into coke. High temperature carbonization produces more gas pitch and aromatic hydrocarbons than does low temperature carbonization. The nature of the products from high temperature operation is the result of the extent to which the initial products of decomposition are changed in the course of their passage from the point of evolution to find escape. The path of volatile products differ in the main types of carbonizing plants used in industry hence the retort itself is a variable of the process.

--F. Estes

COAL GASIFICATION

GASIFICATION OF COAL IN HYDROGEN UNDER PRESSURE. *6th Annual Report Gas Research Board 1944-45. Communication GRB 18, pp 8-18.*

The object of this work was (1) to produce town gas and coke, the reactive coke either to be used to produce hydrogen by the Lurgi process or to be sold as smokeless fuel and the necessary hydrogen being made from coal or coke produced by carbonization processes or by the decomposition of some of the gas produced during hydrogenation or (2) combination with the methane synthesis. First experiments were made with semi-coke but since repeatable results were difficult to obtain due to the irregular segregation of sizes of the coke in the generator, the use of the semi-coke was abandoned. So far experiments on coal have been limited to one coal, a weakly-caking coal. This coal proved to be easily treated. The charge remained open to the flow of gas, hydrogenation was uniform throughout the charge and throughout the coal. It was necessary to preheat the hydrogen to a higher temperature than with semi-coke but ultimate yield of methane was the same. Some tar of a light mobile character was obtained; the yield of ammonia was higher. The solid residue was a light porous material of very high reactivity and very low sulfur content (0.1%). It was found that the use of a 75/25 mixture of hydrogen and carbon monoxide promoted the formation of methane. Increased rate of hydrogen supply reduced the thermal yield of the methane and the calorific value of the gas and also the reaction time.

--R.S. Goodrick

4. CARBONIZATION AND GASIFICATION

GERMAN GASIFICATION INDUSTRY

Hollings, H. REPORT ON THE INVESTIGATION BY FUELS AND LUBRICANTS TEAMS AT THE WINTERSHALL A.G., LUTZKENDORF, NEAR MUCHELN, GERMANY. *U.S. Bureau of Mines Information Circular 7369, 1-21 (1946) July.*

This report deals with the Schmalfeldt gasification plant for making synthesis gas, the Fischer-Tropsch plant, the hydrogenation plant and the catalyst factory, and includes a report on lubricating oil.

HYDROGEN SULFIDE REMOVAL

Reitmeier, R.E. (to The Girdler Corp.) REMOVAL OF HYDROGEN SULFIDE FROM GAS STREAMS. *U.S. 2,405,672 (1946) August 13.*

A process for removing hydrogen sulfide from gaseous mixtures consists of scrubbing the mixtures with an aqueous solution of an alkali metal dichromate and a salt of a metal selected from the group comprising zinc, copper, cadmium, mercury, arsenic, tungsten, tin and vanadium, the acidity of the solution being such as to permit substantial precipitation of the metal sulfides and prevent substantial formation of monochromates.

METHANE SYNTHESIS

Moignard, L.A. and Dent, F.J. THE CATALYTIC SYNTHESIS OF METHANE FOR TOWN GAS MANUFACTURE. *Gas Times 47, 41-43 (1946) April 13; 40-41 May 11.*

A brief description of the investigation of methods of reaction control for the catalytic synthesis of methane from hydrogen and carbon monoxide so that the reaction could be carried out at relatively low temperature and at high space velocity necessary for gas manufacture. The problems of carbon deposition and sintering were experimentally studied. By increasing the rate of heat dissipation and by increasing the proportions of alumina the carbon deposition is decreased and less sintering occurs. For a more detailed discussion of these experiments reference is made to the 49th Report of the Joint Research Committee, Gas Research Board Publication No. 20.

--F. Estes

METHANE SYNTHESIS

SYNTHESIS OF METHANE. *6th Annual Report of the Gas Research Board 1944-45. Communication GRB 18, pp 18-32.*

Work on the synthesis of methane as a possible means of gas making or gas enrichment was continued by laboratories of both the Gas Research Board and the Fuel Research Board. Considerable progress has been made in the preparation of a stable catalyst. It was found that the addition of sulfur as nickel sulfate in the amount of 0.2 parts sulfur per 100 parts nickel reduced carbon deposition without poisoning the catalyst. Increasing the aluminum content and eliminating the manganese likewise reduced carbon deposition. Kieselguhr proved to be a better base than China clay. Experiments have shown that thermal conditions in the catalyst bed are not a major cause of catalyst deterioration. Poisoning of the catalyst by the small amount of impurities remaining in the process gas accelerates the

catalyst deterioration. The rate of deterioration of the catalyst using gas almost completely free from sulfur was less than half that when normally purified gas was used. The use of extended catalyst beds in which the catalyst granules were distributed over considerable length in a horizontal tube has proved promising. Further study on the application of this to pilot plant scale is in progress.

--R.S. Goodrick

SULFUR REMOVAL

REMOVAL OF SULFUR COMPOUNDS FROM WATER GAS AND COAL GAS. *6th Annual Report of the Gas Research Board 1944-45. Communication GRB 18, pp, 32-36.*

In the purification of water gas by passing it over a copper-chromium catalyst at 250°C whereby the organic sulfur compounds are converted to hydrogen sulfide, the conversion is not quite complete due to the establishment of equilibrium conditions. Removal of sulfur compounds with alkaline iron oxide at temperatures of 200-250°C. is suitable for removing the bulk of sulfur compounds but is less efficient when dealing with traces. Treatment of the gas in two or three stages with removal of the hydrogen sulfide between stages is applicable if two stages are sufficient. The thermal losses from repeated heating and cooling make three stages impracticable. Increasing the absorption temperature in the hydrogen sulfide removal did not improve the method. Preliminary results using synthetically prepared adsorbents have shown the use of these materials to be promising. Work on the removal of organic sulfur compounds from coal gas has progressed to an intermediate scale. In preliminary experiment the catalyst vessel was charged with a layer of molybdenum sulfide on activated alumina surmounted by a layer of copper-chromium catalyst on alumina. Space velocities of 2,000 per hour over the molybdenum sulfide and 8,000 per hour over the copper chromium catalyst were used.

--R.S. Goodrick

SYNTHESIS GAS PRODUCTION

Lane, J.C. THE SYNTHINE PROCESS SYNTHESIS GAS PRODUCTION AND PURIFICATION. *Petroleum Refiner* 25, *87-98 (1946) August.*

This is the first in a series of four articles reviewing the application of the "Synthine" process, a term which is defined to include all variations of the Fischer-Tropsch process. The production of synthesis gas (carbon monoxide and hydrogen) from coal by various methods is presented; underground gasification is discussed in some detail. Natural gas as a source of synthesis gas is reviewed. Purification of the synthesis gas is summarized. 178 references.

--C.H. Riesz

UNDERGROUND GASIFICATION

Nusinov, G.O. SUBTERRANEAN GASIFICATION OF COAL. *Canadian Chemistry and Process Industries* 30, *29-32 (1946) June.*

The underlying principle of present methods of subterranean gasification consists of the so-called current process of gasification of coal in the mine. From the surface are sunk two shafts which reach into the coal

strata where they are connected by a horizontal channel dug through the coal seam. The shafts are lined with pipes, and serve as gas passages. Through one air is forced in and through the other, gas is let out. The horizontal connecting channel constitutes the reacting space in which the gasification processes take place. In general the subterranean gasification is very similiar to surface gasification; the process goes through several stages which may be separated into zones depending on the character of the predominating reaction. The chemical processes of subterranean gasification are divided into (1) zone of oxidation in which the oxygen reacts to form CO and CO_2, (2) in the zone of reduction no oxygen is present and the chief products formed are CO and H_2 (3) toward the end the process of carbonization becomes marked and the zone of dry distillation begins. The composition of the gas obtained from subterranean gasification is determined by the composition of the current of air; increasing oxygen content gives higher calorific value of the gas. Before the second world war four industrial installations were in operation. The greatest technical difficulty was reported to be insufficient oxygen supply.

--F. Estes

5. NATURAL GAS AND NATURAL GAS CONDENSATES

CARBON BLACK MANUFACTURE

Pettyjohn, E.S. GERMANY MADE ACETYLENE AND CARBON BLACK BY CRACKING NATURAL GAS IN ELECTRIC ARC. *Natl. Petroleum News* 38, *Tech. Sect.* R-596-R-604 (1946) *August* 7.

Complete details are given of the process developed by the Germans for manufacturing acetylene and carbon black by the thermal cracking of natural gas in an electric arc, using direct current at 7000 volts. The installation described had 15 units, each consisting of two converters, one in service and one in reserve, and individual rectifying system with voltage booster and power factor control. The cracking took place at high temperatures and normal pressures, with rapid quenching to retard polymerization of the low molecular weight hydrocarbons. Mean gas temperature for conversion was 1600°C. After cooling by water spray, the gas passed through a trap and cyclone separators to remove the carbon black, and was then water washed, scrubbed with absorption oil, desulfurized and purified. The acetylene was converted by a four stage process to butadiene for synthetic rubber manufacture. While the Germans seem to have successfully solved the technical details of electric arc cracking of natural gas to produce carbon black and acetylene, the wartime conditions under which the plant was operated prevent an economic evaluation of the process in competition with practice in this country.

--Author's abstract

CORROSION PROTECTION

Senatoroff, N.K. CATHODIC PROTECTION ON LARGE DIAMETER PIPE LINES. *Gas Age* 98, 18-19, 56-57 (1946) *July* 25.

There are two main schools of thought regarding protection of pipelines against corrosion. One is the application of a protective coating consisting of enamels, shielded with asbestos wrapper and the very minimum of cathodic protection; the other is the laying of lines bare using electrical drainage as required. In this article is discussed the cost of corrosion protection as applied to the proposed reconditioning of a section of 26" o.d. high pressure natural gas transmission line in San Joaquim Valley. Conclusions are that the additional cost of providing a thicker protective coating is justified, that line protection by electrical drainage is extended and that station output requirements in amperes is markedly decreased.

--R.S. Goodrick

GUM DEPOSITS

Leonet, G. GUMS IN GAS AND THE PRINCIPAL CHEMICAL PROBLEMS WHICH THAT QUESTION RAISES. *Gas Age* 98, 21-24, 50-54 (1946).

The widespread use of automatic gas appliances has created problems in distribution due to attending gum deposits. The gas industry considers gums to include all materials found in mains and appliances which are characterized as: intermediate between jel and solid state, brown-black in color, insoluble in water, acid and, for the most part, organic solvents. Nearly all the gums considered contained, N, S and Fe as well as C, H and O. Liquid phase gums are considered to be products of oxidation, sulfiding

and of polymerization of diolefine hydrocarbons having a more or less elevated boiling point. These gums are partly soluble in benzol by which means they are eliminated from the gas. Vapor phase gums have their origin in the unsaturated and most volatile constituents of gas, notably, diolifin hydrocarbons and ketones. The diolefins polymerize in the vapor phase due to the action of nitric oxide and nitrogen dioxide. Vapor phase gums are always rich in nitrogen and not appreciably soluble in benzol. The most predominant method of gum formation is by condensation of two or more molecules with the elimination of a small molecule. This is in accord with the high oxygen content of the gums and with the role of free oxygen in the formation of oxygen containing compounds identified. The presence of sulfur compounds also seem to accelerate the formation of gums and the accompanying organic acids. A comparison of the chemical composition of coals and gums in gas is presented. From this comparison it is concluded that coals and gums may be considered as materials of similar constitution and it is proposed that the gums of gas contain bitumen, humic acids and humine.

--F. Estes

HELIUM AS A TRACER

HELIUM USED BY BUREAU OF MINES TO TRACE TRAVEL OF INJECTION GAS. *Oil & Gas J.* 45, 107-109 *(1946) August 10.*

The U.S. Bureau of Mines employs helium as a tracer in exploring conditions in natural gas reservoirs. Helium is injected into a selected well in the area and its appearance in adjacent formation offers an indication of the structure of the region.

RECOVERY SYSTEMS

Rogers, D., Jr. GAS RECOVERY SYSTEMS. *Oil Weekly* 122, 42-44, 47 *(1946) August 19.*

In fields where gas is becoming relatively scarce, its recovery is economically feasible. By gas recovery is meant the salvage of solution gas escaping from produced crude oil either at low pressure or under vacuum, and the use of such gas as lease fuel. The essential features of automatically operated recovery systems are summarized in this article.

--R.S. Goodrick

REFORMING WITH LP GASES

Kopp, H.M. USE OF LIQUEFIED PETROLEUM GASES FOR REFORMING AND COLD ENRICHING. *Gas* 22, 33-36 *(1946) August.*

An evaluation based on 15 years operating experience of the use of LP gases for reforming and cold enriching is presented. LP-gas is an important means of furnishing peak capacity for house heating loads. However, there are certain limitations to its use. Storage and transportation costs of LP gas are very high so that LP-gas is not likely to compete with low cost oils in large gas plants. In plants reforming heavy oil in generators, the use of LP-gas would be limited from the standpoint of capacity since both could not be reformed at the same time. It is possible that considerable amounts of LP-gases could be reformed in coke ovens during the last hour or two of their charging period. It has been found that mixtures of coke oven gas, producer gas and propane gave excellent operation characteristics on all types of burners.

--R. S. Goodrick

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

ALKYLATION

Gorin, M.H., Kuhn, C.S., Jr. and Miles, C.B. MECHANISM OF CATALYZED ALKYLATION OF ISOBUTANE WITH OLEFINS. *Ind. Eng. Chem.* 38, 795-799 (1946) August.

Supporting evidence is presented for a simple mechanism which explains the products of the primary alkylation reaction of isobutane with olefins, catalyzed with acids and aluminum halides. This mechanism excludes certain products which are not experimentally detected in important quantities. Primary alkylation products are defined as those alkanes which are formed preferentially and in high yields at low temperatures and short residence times. Formation of these products and the secondary isomeric products is ascribed to the simple addition of methyl and isopropyl fragments (from isobutane) to the various permissible forms of an olefin-catalyst complex.

--Author's abstract

CATALYTIC CRACKING

Bland, R.E. and Smith, E.A. EARNINGS--A FUNCTION OF CATALYST ACTIVITY. *Petroleum Engineer* 17, 55-60 (1946) August.

Considerable confusion exists with regard to the terms "catalyst makeup" and "catalyst loss." "Catalyst loss" in this article is taken to mean that quantity of catalyst that is mechanically lost from the system. "Catalyst make-up" is taken to mean the sum total of catalyst added to the system to make up mechanical losses plus catalyst added to the system (balanced by physical catalyst withdrawal from the system) to maintain optimum catalyst activity. For example, TCC units will operate on clay catalyst with a mechanical loss of 0.1 lb, per bbl. This article shows, however, that to maintain optimum catalyst activity from the standpoint of economics, equilibrium catalyst should be withdrawn from the system and replaced with additional fresh make-up. For the example taken in this article, the total optimum catalyst replacement is indicated to be 0.8 lb. per bbl. for maximum profit.

--Author's abstract

CATALYTIC CRACKING

Cauley, S.P. and Delgass, E.B. CARBON-HYDROGEN RATIO OF CATALYTICALLY CRACKED DISTILLATE FUEL OILS. *Oil & Gas J.* 45, 166-169 (1946) July 27.

From the properties of pure compounds, an empirical relationship has been established between carbon-hydrogen ratios and an arbitrary factor "A", where

$$A = \frac{\text{Aniline pt. °F} \times \text{°API}}{100} - \frac{\text{Boiling pt. °F}}{20}.$$

This correlation has been used to study catalytically cracked distillate fuel oils. It was found that relative performance ratings of distillate fuel oils in burner tests correlated well with the estimated C/H ratios.

--C.H. Riesz

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

CATALYTIC CRACKING - HOUDRY

Lassiat, R.C. and Thayer, C.H. IMPROVED DESIGN OF HOUDRY REACTOR RESULTS IN HIGHER GASOLINE OUTPUT. *Oil & Gas J.* 45, 84-88, 95 *(1946) August* 3.

Changes in the physical composition of the catalyst and improved new design of reactor tubes have resulted in important improvements in the operation and results from the Houdry catalytic cracking process, pioneer in commercial catalytic cracking. The new design cuts sharply the cost of changing catalyst. Shutdown time is reduced; heat capacity of catalyst is increased by mixing with an inert material of high heat capacity. All tubular elements handling air and oil vapors are easily removable from the catalyst case. Coke-burning capacity is increased and maximum temperatures during burning are reduced by the new design.

--Author's abstract

ISOMERIZATION

Oblad, A.G. and Gorin, M.H. ISOMERIZATION OF n-BUTANE CATALYZED BY ALUMINUM BROMIDE. *Ind. Eng. Chem.* 38, 822-828 *(1946) August.*

The isomerization of n-butane with aluminum bromide as catalyst was studied in this laboratory several years ago. During the course of the investigation the effect of various promoters was determined. Oxygen was discovered to be an outstanding promoter for the isomerization reaction, and in the ensuing work most of the studies were concerned with the effect of oxygen. The rate of isomerization decreases with time because of oxygen consumption. The factors which influence oxygen and catalyst consumption were determined, and the promotional effect of oxygen is compared to that of other substances. The mechanism of the promotion of aluminum bromide as an isomerization catalyst is discussed. It is suggested that surface is necessary to assure a polar medium in which the reactions involved can take place.

--Author's abstract

7. ANALYTICAL METHODS AND TESTS

DETERMINATION OF ORGANIC SULFUR

MacHattie, I.J.W. and McNiven, N.L. AN APPARATUS FOR THE DETERMINATION OF ORGANIC SULPHUR COMPOUNDS IN MANUFACTURED GAS. *Canadian Chemistry & Process Industries* 30, 87-92 *(1946) July.*

Apparatus and procedure developed at the Ontario Research Foundation for the determination of organic sulfur in manufactured gas is fully described and illustrated. The method is based upon sulfur found by burning samples of the gas under test before and after passage through a series of selective absorbents. Sulfur oxides formed in the combustion are absorbed in 1% hydrogen peroxide solution and determined either gravimetrically or volumetrically. The selective absorbents employed are: (1) Alkaline cadmium chloride reagent for mercaptans, (2) concentrated sulfuric acid for thiophene, and (3) kerosene in a countercurrent scrubber for carbon disulfide. Four simultaneous determinations are run to characterize the sulfur in a gas as follows: (1) Total sulfur, (2) mercaptan sulfur, (3) thiophene sulfur, (4) carbon disulfide, sulfide sulfur, and (5) carbon oxysulfide sulfur. Test gas is fed under pressure to the various units from a manifold by means of a small rotary pump, and purified air for combustion is supplied from a cylinder of compressed air. Air and gas volumes are measured with calibrated capillary flowmeters. The results of three analyses made on coal gas are given. The authors estimate an accuracy of ±0.2 grain for gases containing about 15 grains of sulfur per 100 cubic feet.

--H. Hakewill

HYDROCARBONS EX KETENE

Warner, B.R., Derrig, M.J. and Montgomery, C.W. CATALYTIC SYNTHESIS OF HYDROCARBONS AND OXYGENATED COMPOUNDS FROM KETENE AND ITS RELATION TO THE FISCHER-TROPSCH SYNTHESIS. *J. Am. Chem. Soc.* 68, *1615-1617 (1946) August.*

Ketene in the presence of hydrogen reacts on a Co-ThO_2-kieselguhr catalyst to yield hydrocarbons and oxygenated compounds which are similar to the products of the Fischer-Tropsch synthesis. The possibility that ketene is an intermediate in the Fischer-Tropsch synthesis is discussed.

10. CHEMICAL ENGINEERING

AIR CONDITIONING THERMODYNAMICS

Palmatier, E.P. THERMODYNAMICS FOR THE AIR CONDITIONING ENGINEER. *Heating & Ventilating* 43, 84-94 (1946) August.

In this second section of his two-part article on thermodynamics, Mr. Palmatier describes the nature of substances and cycles and shows how the principles he has discussed are applied in air conditioning and refrigeration. The theory of psychrometry is also taken up and various examples are worked out.

--Editor's abstract

MEASURING DUST PARTICLES

TERMINAL VELOCITY FOR MEASURING DUST. *Combustion* 18, 31-32 (1946) July.

The author stresses the advantages for many engineering applications of expressing the size characteristics of dusts in terms of terminal velocity rather than particle diameter. The actual terminal velocities are often of great practical importance, and while these can be related to diameters through Stokes Law, large errors may be introduced through variations in the shapes and densities of the dust particles, The author suggests "inches per minute" as a convenient engineering unit for expressing terminal velocities of dust particles in air.

--M.A. Fisher

ORIFICE CALCULATIONS

McReynolds, E.E. STREAMLINED ORIFICE CALCULATIONS. *Petroleum Refiner* 25, 130-135 (1946) August.

Charts are presented for speeding up orifice calculations. Of special interest is a chart for allowing for the thermal expansion of the orifice.

--J.D. Parent

REAL GASES

Su, Gouq-Jen and Chang, Chien Hou. A GENERALIZED VAN DER WAALS EQUATION OF STATE FOR REAL GASES. *Ind. Eng. Chem.* 38, 800-802 (1946) August.

In process industries which involve the use of moderate or high pressures, a knowledge of the compressibilities of the gases or vapors in question is essential for the design and operation of the equipment. In this the first of three papers the generalized van der Waals equation of state is considered. It is shown that the proposed equation is good for seventeen gases almost up to the critical density with an average deviation of 3% or less.

REAL GASES

Su, Gouq-Jen and Chang, Chien-Hou. GENERALIZED EQUATION OF STATE FOR REAL GASES. *Ind. Eng. Chem.* 38, 802-803 (1946) August.

A generalized equation of state for real gases is proposed, and the three constants involved are determined. The values of the constants are the same for all gases. The equation is valid up to about twice the critical density with an average deviation of 2% or less for each gas.

--Author's abstract

REAL GASES

Su, Gouq-Jen. MODIFIED LAW OF CORRESPONDING STATES FOR REAL GASES. *Ind. Eng. Chem.* 38, *803-806 (1946) August.*

A modification of the law of corresponding states is proposed. A term called the ideal critical volume is defined, and the ratio of volume over the ideal critical volume is called the ideal reduced volume, to be used in place of the reduced volume. It is shown that, for seventeen gases within the temperature and pressure ranges studied, the over-all average deviation is 1%. The value of the critical ratio is not a restriction or a criterion for the applicability of the modified law.

--Author's abstract

II. PROCESS EQUIPMENT AND INSTRUMENTATION

FLOWMETER

Prahl, E.P. PORTABLE 3-FLUID U-TUBE STAND SPEEDS FLOWMETER TESTING. *Power* 90, *83-85 (1946) August.*

Setup consists of two large-diameter head equalizers and U-tubes for water, tetrabromoethane and mercury. Using air to produce differential head, this apparatus cuts man-hours in half and eliminates the high, difficult to adjust water column.

--Author's abstract

GAS TURBINES

Fernald, E.M. EXPLORATORY EXCURSION INTO GAS-TURBINE PATENTS. *Mechanical Engineering* 68, *727-732 (1946) August.*

The scope of the paper is restricted to patents issued between January, 1925 and July, 1945 relating to stationary and marine plants of the continuous combustion type. Several patented schemes are discussed from the thermodynamic point of view, and some relatively unpublicized ideas are mentioned. A digest of patents is appended.

OXYGEN TEST METER

Gardner, W.F. and Norris, R.E. OXYGEN TEST METER. *Gas* 22, *37-38 (1946) August.*

The paper describes an oxygen testing instrument developed in Great Britain to meet a wartime need in connection with operation of barrage balloons. In such balloons, the gas gradually becomes contaminated with oxygen from inward diffusion of air through the envelope, and a potentially explosive condition ultimately develops. When pure hydrogen was used it was comparatively simple to test for oxygen with existing thermal conductivity apparatus. However, when it was found necessary to use hydrogen mixed with coal gas in percentages not in excess of 20% of the latter, a new testing method became necessary. It is believed that this method will have interest and peacetime application to the American gas industry-for example, in a gas-making plant, for testing the atmosphere in mains or vessels when purging operations are in progress.

--Editor's abstract

SMOKE MEASUREMENT

PHOTO-ELECTRIC SMOKE MEASUREMENT. *Gas & Oil Power* 41, *233-235 (1946) July.*

Description of a simple photoelectric instrument for measuring the optical density of oil engine exhaust is given. The instrument consists of a 2-foot tube with a light source at one end and a barrier-layer photocell at the other. Cell output is measured by a low resistance micro-ammeter, and the smoke is drawn through the tube by means of a small centrifugal blower.

--M.A. Fisher

PERIODICALS ABSTRACTED FOR GAS ABSTRACTS

AMERICAN GAS ASSOCIATION MONTHLY

AMERICAN GAS JOURNAL

AMERICAN PETROLEUM INSTITUTE QUARTERLY

AMERICAN SOCIETY FOR TESTING MATERIALS BULLETIN

AMERICAN SCIENTIST

BERICHTE DER DEUTSCHEN CHEMISCHEN GESELLSCHAFT

BITUMINOUS COAL RESEARCH

BLAST FURNACE AND STEEL PLANT

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS: SECTIONS A AND B

BRITISH COAL UTILISATION RESEARCH ASSOCIATION MONTHLY BULLETIN

BULLETIN AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

BULLETIN AMERICAN CERAMIC SOCIETY

BUTANE-PROPANE NEWS

CALIFORNIA OIL WORLD

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CHEMICAL INDUSTRIES

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CHEMISTRY AND INDUSTRY

COKE AND SMOKELESS FUEL AGE

COMBUSTION

COMPRESSED AIR MAGAZINE

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ENGINEERS' DIGEST

FUEL IN SCIENCE AND PRACTICE

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GAS AGE

GAS AND OIL POWER

GAS APPLIANCE MERCHANDISING

GAS JOURNAL

GAS NEWS

GAS TIMES

GAS WORLD

GREAT BRITAIN FUEL RESEARCH INTELLIGENCE STATION ABSTRACTS

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INDUSTRIAL AND ENGINEERING CHEMISTRY: ANALYTICAL EDITION

INDUSTRIAL AND ENGINEERING CHEMISTRY: INDUSTRIAL EDITION

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INSTITUTION OF GAS ENGINEERS: BULLETINS, COMMUNICATIONS AND TRANSACTIONS

INSTRUMENTS

IRON AGE

JOURNAL OF THE AMERICAN SOCIETY

JOURNAL OF THE AMERICAN CHEMICAL SOCIETY

JOURNAL OF APPLIED MECHANICS

JOURNAL OF APPLIED PHYSICS

JOURNAL OF CHEMICAL EDUCATION

JOURNAL OF CHEMICAL PHYSICS

JOURNAL OF CHEMICAL SOCIETY (LONDON)

JOURNAL OF THE INSTITUTE OF FUEL

JOURNAL OF THE INSTITUTE OF PETROLEUM

JOURNAL OF ORGANIC CHEMISTRY

JOURNAL OF PHYSICAL CHEMISTRY

JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS

JOURNAL OF THE SOCIETY OF CHEMICAL INDUSTRY

LP GAS

MATERIALS AND METHODS (METALS AND ALLOYS)

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MINING AND METALLURGY

MINING TECHNOLOGY

NATIONAL GAS BULLETIN OF AUSTRALIA

NATIONAL PETROLEUM NEWS

OEL UND KOHLE

OFFICIAL GAZETTE OF THE U.S. PATENT OFFICE

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OIL WEEKLY

PETROLEUM

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TRANSACTIONS AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

TRANSACTIONS AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

TRANSACTIONS AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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